Opening the reserve of economic efficiency in logistical and facility management services.

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1. Situation at the outset

In many branches companies often lose the **visibility** of their human and technical resources of their field service. On the one hand the people in the fieldservice are often free like kings on the other hand they do not take part of the daily communication in the central office and suffer under the lacking involvement in the decisions inside the central office. The result is **inefficiency**. Reproaches in both directions follow. With the radio systems and then mobile phones the ditch began to dry up. But the solutions are far from being productive.

2. Efficiency pro or con

Productivity is the effective use of innovation and resources to increase the value added and content of products and services. **Efficiency** is the productivitie's result. When human resources are involved, the rated efficiency seems to be often a taboo. Whereas the logistics have overcome such ideas of resistances, many public and private branches with fieldservices feel a lot of resistance. The labour unions and the deep antipathy of all people against being controlled lets people deny these thoughts as a reflex. This is astonishing because the economy thinks the whole day about having more productivity and efficiency. Looking to South East Asia the governments encourage and reward both: the improvements of productivity and efficiency. In this country there is a splitted view on this.

It is a fact that even employers do not like to bring too much **transparency** into the system of invoicing their clients, because the necessary stages of generalisation could be destroyed. But the competition and the attention of the client destroy the possible profits in such niches. The rating of the achievement will be trump.

This effect is well known in case of the earth mass transport, where the service firms like it more to count the trucks instead of measuring up the exact mass differences before and after taking out. Counting trucks the price per m^3 is much lower in the competition than in case of exact earth mass survey. For a long time the survey of earth mass was too expensive, but now things change.

The economic process of a field service is a complex thing and it has at least two levels of generalization, where the first is clearly disadvantageous for the client. The generalisation performed by the employee, who tends to include driving time, pauses or little times of absence of work in his work report is often not corrected by the final invoicing of the process in view of the competitor or under the strict control of lump sums.

But down the road the need of **transparency** in the economical process will take its place in the field service in a concert together with the over all technical solutions, which are able to create value added.
Modern sensor techniques will conquer the area.

3. All logistic problems are complex

The description of the logistical problems coming up, when cars / trucks / bikes / machines move from the place A to B is very complex. Concerning the character of the value adding economical process this description of the simple vehicle move from A to B is very diverse.

- Description of the economic function
- Object (value adding process) oriented description
- Cost related validity
- Person related validity
- Machine related validity
- Dataflow oriented conditions.

Most time it is needed to use several forms of description for the fulfilling of the complex task of finalizing an economic process technically and economically as well as in terms of book keeping. The transformation of the accruing information from one stage to the next is a sophisticated task. It needs the comprehension of the seperated professions and their internal knowledge.

The data evaluated in this paper come from a surveying office and comprise the moving of two vehicles over the whole year 2005. An engineer and one helper and a van full with material for marking points in the field and measuring and surveying tools like total station and measuring tapes. They get their jobs for the day in the morning and drive from place to place.

Table 1 gives an impression of the active jobs inside one town during the year 2005.

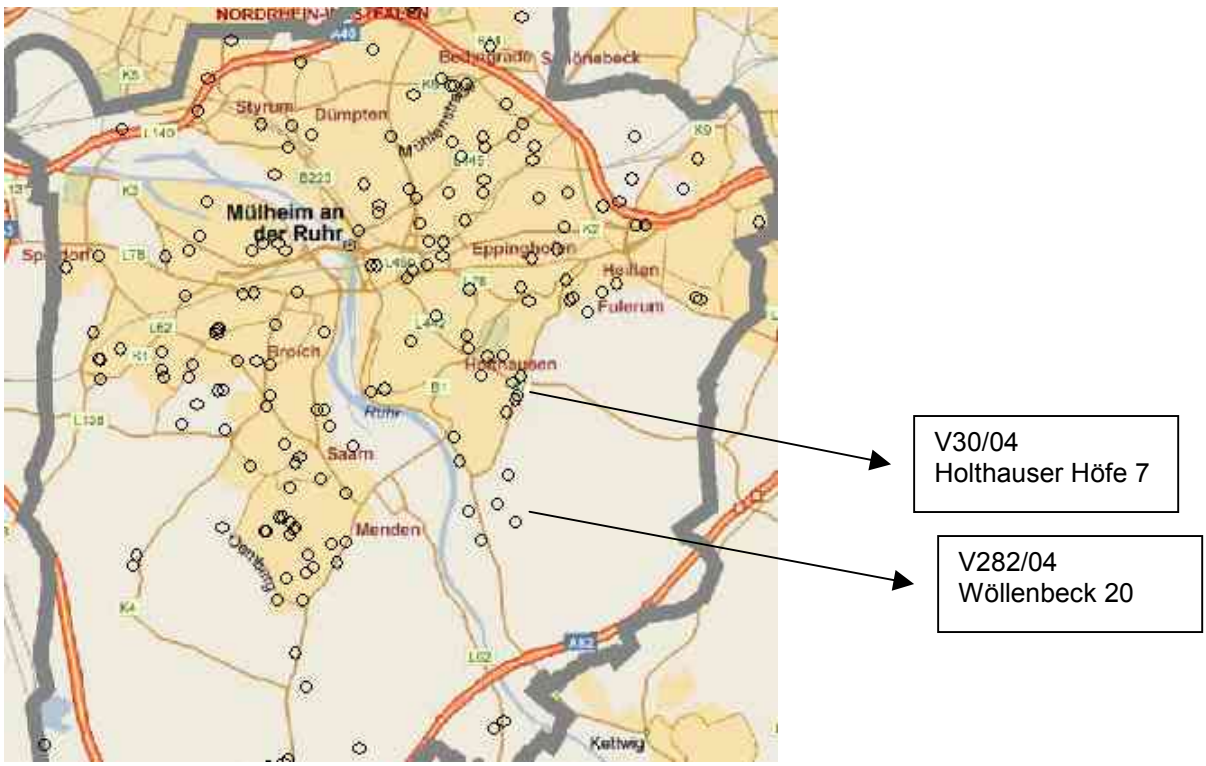


Abb. 1 Orders to be worked off in 2004 / 2005

The little circles flash up as soon as the order of a client is registered and the coordinate is fixed. It vanishes in case the order is fulfilled i.e. the job is disbursed by the client. To find the coordinate of an order is for a surveying office an easy thing. The coordinate is always part of the work, which has to be performed. The evaluation software checks, if a vehicle comes nearer than 20 or 100[1] m to the coordinate and identifies the place of work with the order in case of standing their more than 5 minutes.

Radio Frequency Identification (RFID), combined with telematics, can provide supply chain visibility, boost operational efficiency and give companies the flexibility to react on the fly to changes in demand. This powerful combination can help companies achieve high performance no matter what the economic climate. When combined with Telematics—technology that provides remote access to data about vehicles over a wireless network—RFID can be used to analyze the condition of a piece of equipment. Logistics managers will know, for example, if the temperature or pressure of a piece of equipment is not in the normal operating range or even they know the amount of gaz I the bumper. This can lead to improved maintenance of the equipment.

In terms of operating efficiency, RFID will give companies more accurate information about how products are being routed. They can make quick decisions based on the changing needs of customers and communicate that to make sure packages are where they need to be.

The need of different branches is diverse: Such a surveying office is interested in the working time, which means to be interested in the stopping time at an place, where the assignment has to be performed. A service firm for farmers or a communal service institution likes to see the move of the vehicle in a certain area (field, street, etc.) or the stop at a certain client. Companies often lose visibility of their products—if not the products themselves—the minute they put the goods on a truck, railcar or ship. As a result, they have to maintain higher levels of safety stocks. They don't use their assets efficiently, and they don't have the flexibility to react when goods need to be rerouted on the fly. But RFID could help address each of those issues.

In every case the variables “locality” and “sensor state” in relation to the time is wanted for being evaluated. In the following the sensor state is outside of this consideration.

[1] The interpreter can chose the distance

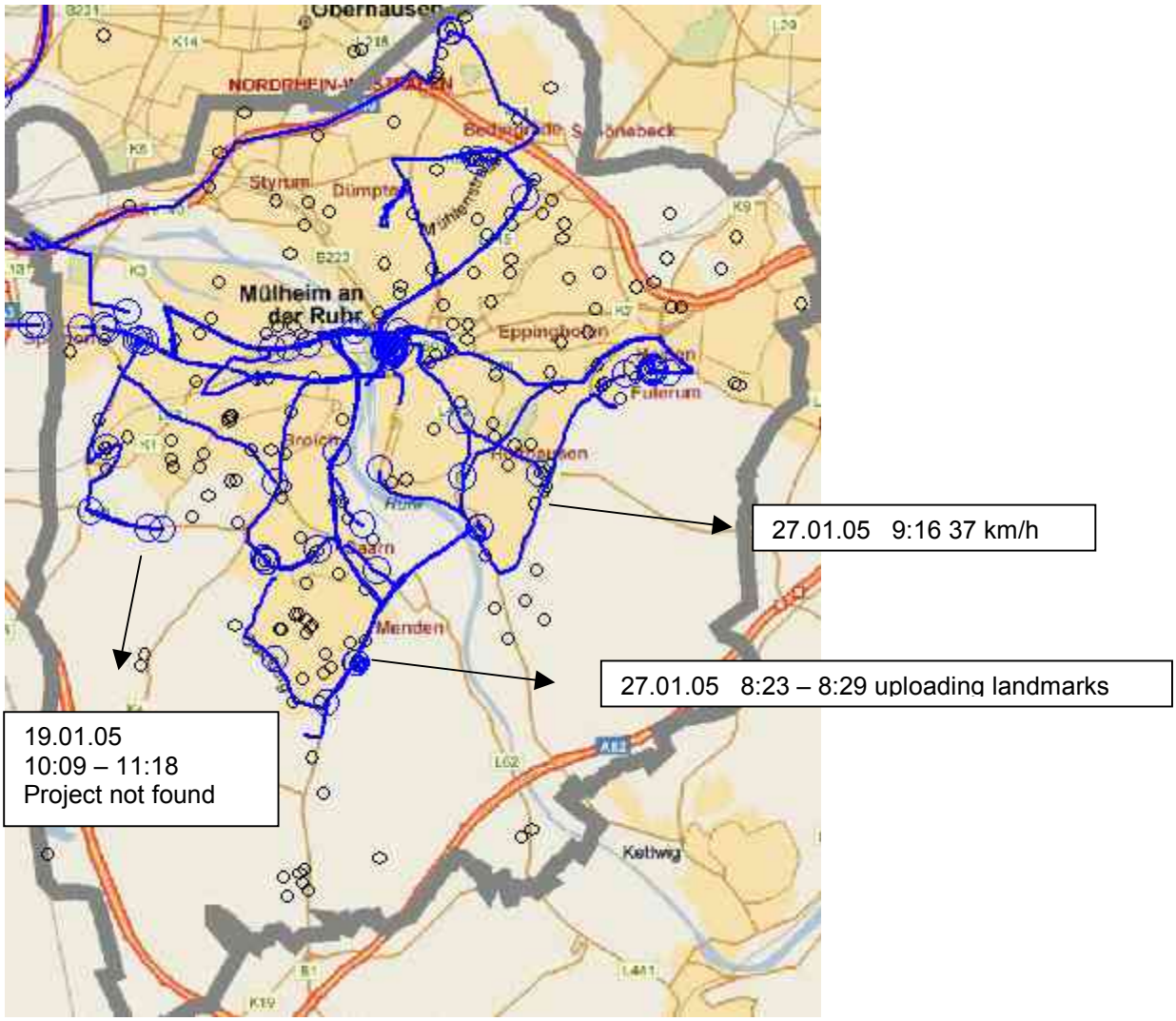


Abb. 2 Vehicle – Routes in January 2005

Inserting the picture on a vehicle move of Team 1 in January 2005 the big thin circle show the places of a longer stop, where either a project could be identified or a project has not been found.

4. Ongoings over one year of survey

The signal coming in at the server contains the different necessary information like box number, datum, time, coordinates and sensor spectrum. In the following chart are the incoming data for two boxes shown.

50012	20060606121324	$GPGGA,101158.422,5126.0857,N,00652.4815,E,1,06,1.7,82.1,M,,,,0000*3F $GPRMC,101158.422,A,5126.0857,N,00652.4815,E,0.04,126.89,060606,,*0E $GSKEY,0,1,1,1,1,1,1,1*42
50112	20060606121323	$BOXID: 50112 $GPGGA,101157.078,5206.1664,N,01227.1379,E,1,08,1.0,190.1,M,,,,0000*0D $GPRMC,101157.078,A,5206.1664,N,01227.1379,E,3.73,297.15,060606,,*08 $GSKEY,1,1,1,1,0,0,0,9*4°
50012	20060606121319	$GPGGA,101153.422,5126.0860,N,00652.4824,E,1,06,1.7,81.3,M,,,,0000*33 $GPRMC,101153.422,A,5126.0860,N,00652.4824,E,0.05,47.94,060606,,*38 $GSKEY,0,1,1,1,1,1,1,1*42

Box Number, Datum and time, coordinates and sensor data follow all fie or more seconds. The process is now very stable and secure, after a lot of development endeavours. To deliver a secure result the software has to take regard of a lot of cases where the data shown up are not sufficient:

a) Blackout of the GPS signal
At the central place of GEOhaus, where the teams started every morning lies between high buildings and so does not allow to admit the GPS – signals well. As a result there are no GPS data for one or two minutes. To bridge that we made a software. Other blackouts happened fortunately not very often. The GPS – signal is stable and the loss of data because of trees are short because of the motion of the vehicle. The two teams had two different installations:
Team 1 : Geobox smart without a GPRS telephone; the data wered stored only during the time when the motor was on. The team could not interfere the storing of data in any way.

b) Blackout of the GPRS telephone

The team 2 had a mobile GPRS telephone inside GEOBOX smart. It had to be started in the morning and been deactivated in the evening. This was the only interference to be enacted by the team. In the first half year there was a lot of disabling by the GPRS service, which improved after a lot of experimental work.
The result is that we have used for the team 2 only 86 days, whereas we could register in team 1 202 days with sufficient data. The weak point is still now the GPRS telephone and its many breaks during the driving time. With this solution we have no absolute breaks when the motor is out. On the contrary during that time there is more stability than during the driving time. It needs a lot more of evaluation time to identify the lines and their work related ends than we have invested now. Nevertheless the problems are solvable or at least to be bridged by software solutions. It must be said, that these breaks are disturbing the evaluation more than the actual overview over the teams in motion. So the evaluation can be improved by re-enacting the lines by viewing the ways on the map.

c) Blackout of the server

The server proved to be very stable, even if the software of storing the data coming every 5 seconds had to be developed during that time.

d) Working Stop of a vehicle outside of the job identification radius
If a stop longer than 5 minutes happens to be inside a chosen radius around the fixed coordinate of the job the time of standing by is identified as working time. It comprises also the lunchbreaks if the team didn't drive for that purpose to other places.

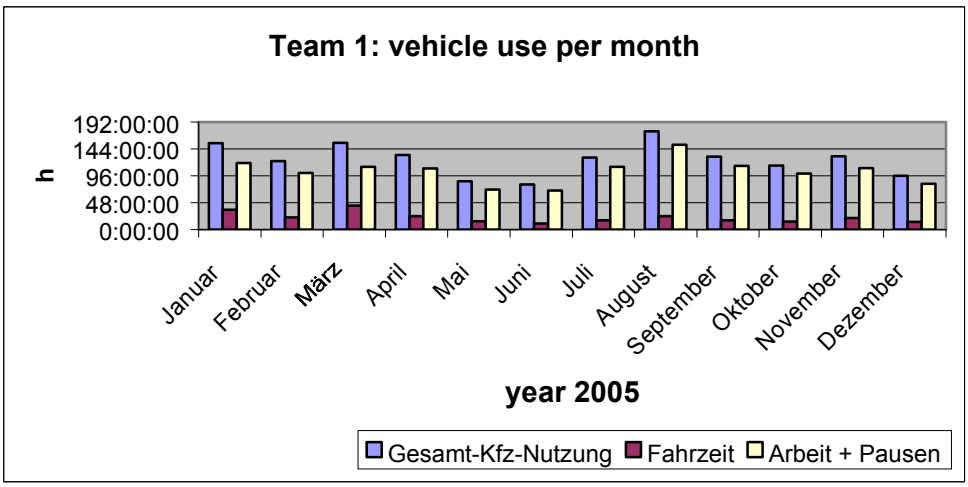
e) Non-working-stop inside of the job identification radius

Such non-working.stops can be identified by the breaks at fixed time; so is the breakfast break from 10:00 to 10:21 am and the lunch break from 1:00 to 1:30 pm. The geobox smart allows with its additional sensors also the identification of the persons in the car, so that times of pause by rain or other reasons could be identified. But in these tests here this feature wasn't applied. Another sort of stops happened when the team drove to the gazoline station "Tramin" and to "Geosat" where the demarcation material is based. One indication on deficiencies in the organization is the number of returns to the central Geohaus during the day. These returns happen,

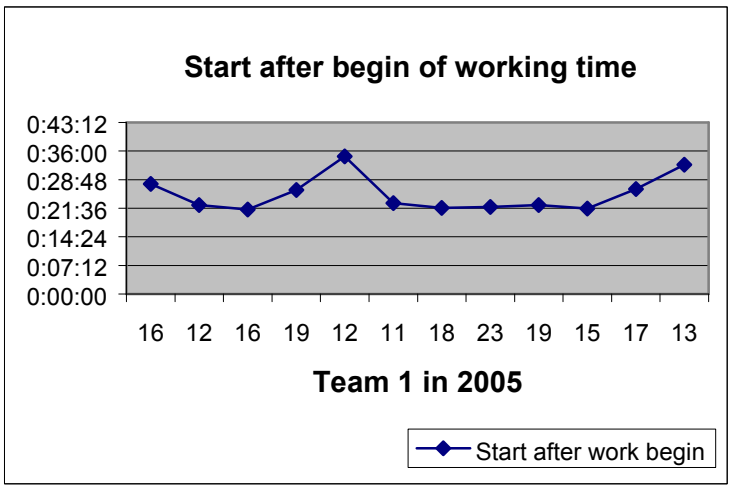
when the working papers are not sufficient or the working plan for the day is disturbed or confused or unsufficiently planned.

5. Results of one year long test

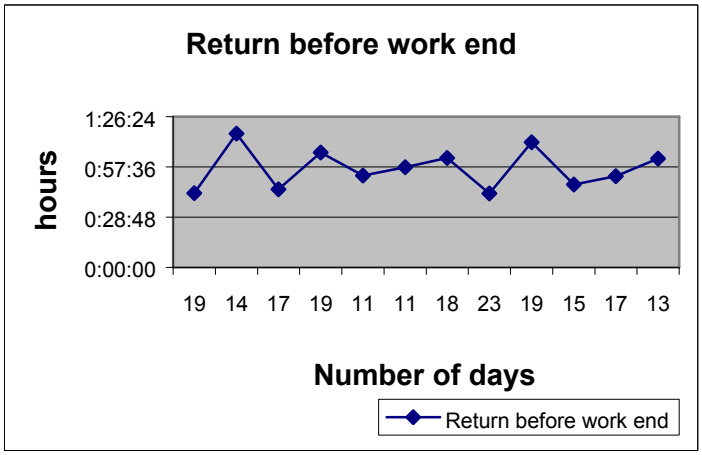
The endurance of the vehicle during the year is at the first glance different from month to month. Vacancies of the engineer, blackout of the geobox influence this picture. But looking in detail shows that there is an certain potential for improved use of the vehicle with all its tools and toolkits.



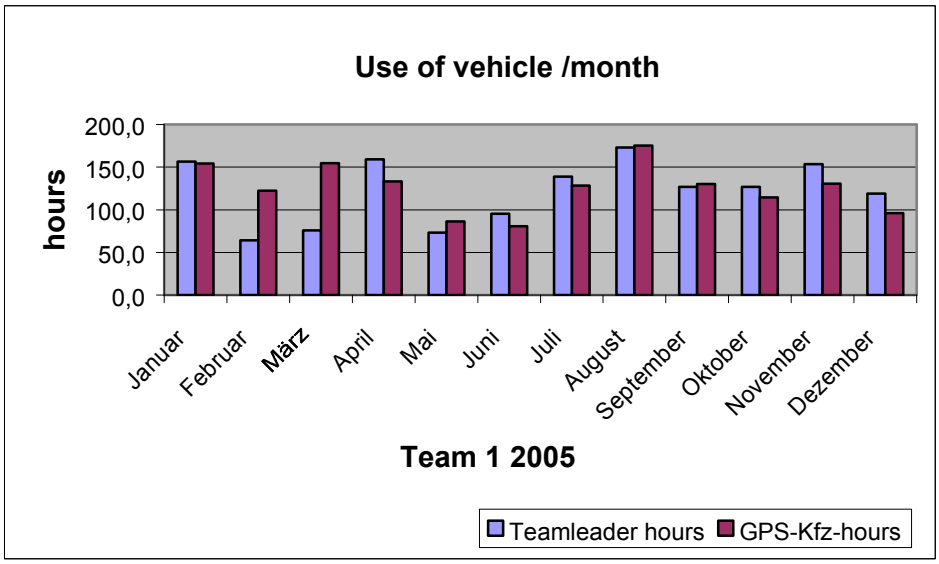
The driving time is assignment related but together with the graphic overview over the single day, it is suddenly clear, that time savings of 20 % are to be gained without any difficulty. A lot of travelling time is senseless as is was shown in the farming sector or elsewhere.



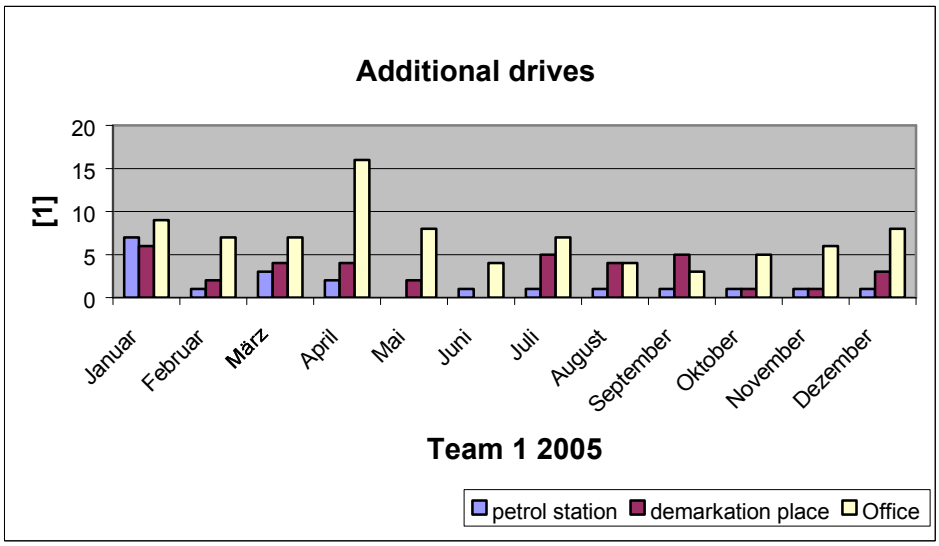
Since people are used to start in the morning, precious working time is lost. Many experiments have indeed shown, that the pressing of work does not bring more concentration. The easy idea to place the preparation work into the last evening is practically immpassable.



Another game is the time in the evening. Here it is a question of dataflow and the introduction of better software to make this work shorter.



The table shows, that a vehicle has been used by more than one person. Taking all vehicles together it became clear that the overhang in the number of vehicles is between 30 to 50 %.



The number of drives to the center is flashy. It is a reason of lacking preparation and lack of small jobs in the summer 2005. Indeed a great deal of them shuwed up to be avoidable.

6. The interlinking with data of other origin

In every firm there are accruing a lot of data for the organisation and the documentation. The employees in Geohaus are used to document their work and time as well in a function oriented as in an object oriented way. In this connection it was interesting to compare the working time of the team outside with the GPS related working time. This information can be taken directly out of the workbook, which is filled up every evening. The second information is the number of weighted points, which is controlled and counted by the field service manager every evening. “Weighted” means that the highly different work load between a topographical point, a cadastral point and four other sorts of points is scaled by multiplication with certain factors. The difference between the results in the different months and even more between the days show that

- the preparation work takes a lot of time. It is also not to denied that
- the weather has a lot of influence on the output. At least
- the teams are not every day going strong.

7. The improvement of the productivity and the efficiency

The tables give a lot of indications for improving the efficiency of the field service. The main factor for getting better productivity is the visibility of the teams in the map. The remote access to the site makes decisions on the fly possible. The second main factor is the easy and secure process of invoicing the client, which has a deep effect on the productivity.
Mainly these factors bias a better efficiency by

a. Reduction of travelling time
   The reduction of travelling time is of course the first idea in view of the results. So it is not to be understood at the first glace that the teams come back to the centre one hour before end of work. But it shows, that the results need preparation before handing them over for the AD-check[2]
   And indeed it can be shown that a good preparation shortens the field service time immensely. Especially the transition from the reestablishment of boundaries on behalf of working papers in the field by preparation of digital coordinates and their setting out on behalf of electronic data flow can improve the efficiency enormously. The better predisposing by installation of the geobox reaches quickly 20 % reduction of travelling time.
b. Minimization of the travelling time for quick performing assignments by having the vehicles in view
c. Mastermind the interest of the employees to better work (less payment for travelling time, better payment for results)
d. Mastermind the interest of the clients to the transparency and efficiency (ratio of transport and working time / achievements).

It is no question that the implementation of a tracking system has a great impact on the productivity and effectivity of a company. The long time experiments have also shown that misgivings have been resolved.

Literature:

1. Schuster, O; Ludwig, O; Busch, M: **Projektdaten für Entscheider – Effektive Nutzung von Geodaten im System GEOhaus®** CORP Geo-Multimedia 02/04 Tagungsband i.V.
2. Schuster,O: **Rationalisierung, Vertiefung und Verbreiterung des Aufgabenfeldes durch geodätische Kontrolle und Metadaten;** VGI, Vermessung + Geoinformation, 2003

[2] Every evening the results are subjected to a check with 5 questions and the performance of the statistics.